

Kaytheon MIL-M-15071C(SHIPS)
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MILITARY SPECIFICATION

MANUAL, TECHNICAL, FOR MECHANICAL

AND ELECTRICAL EQUIPMENT (LESS ELECTRONICS)

1. SCOPE.

1.1 Scope. — This specification covers the minimum requirements for preparing and revising technical manuals for electrical and mechanical equipment(s). The requirements for electronic equipment are covered in Specification MIL-M-16616. In addition, it covers the requirements for approval procedures; production and reproduction; quality and distribution; and packing and packaging.

1.2 Classification. — Technical manuals shall be of the following types as specified (see 6.1):

Type I — Type I manuals are required for experimental equipment procured to determine either military suitability or the ability of a manufacturer to meet military specifications. (See 3.1 and 3.2)

Type II - Type II manuals are required where the equipment to be described has no direct commercial counterpart or which is sufficiently complex that more extensive information is necessary. (See 3.1 and 3.3)

Type III — Type III manuals are required where the equipment to be described is an adaptation or variation of conventional commercial equipment, where, with certain modifications and additional data, the type of instruction matter normally furnished will serve the purpose. (See 3.1 and 3.4)

Type IV — Type IV manuals are standard commercial manufacturers' instructions on relatively simple equipment which will be adequate subject to minor modifications. (See 3.1 and 3.5)

2. APPLICABLE DOCUMENTS

2.1 The following specifications, standards, drawings and publications, of the issue in effect on date of invitation for bids form a part of this specification:

SPECIFICATIONS

FEDERAL

LLL-B-631-Boxes; Fiber Corrugated (for Domestic Shipment).
 LLL-B-636-Boxes; Fiber Solid, (for Domestic Shipment).
 PPP-B-585-Boxes; Wood, Wirebound.
 PPP-B-591-Boxes; Fiberboard, Wood-Cleated.
 PPP-B-601-Boxes; Wood, Cleated-Plywood.
 PPP-B-621-Boxes; Wood, Nailed and Lock-Corner.

MILITARY

JAN-P-108-Packaging and Packing for Overseas, Shipment Boxes, Fiberboard (V-Board and W-Board),
 Exterior and Interior.
 MIL-P-116-Preservation, Methods of
 MIL-B-10377-Boxes; Wood-Cleated, Veneer, Paper Overlaid.
 MIL-L-10547-Liners, Case, Waterproof.

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NAVY DEPARTMENT

General Specifications for Inspection of Material.

STANDARDS

MILITARY

MIL-STD-218-2 Technical Manuals Part 2 – Production or Procurement of Artwork for Technical Manuals.

MIL-STD-218-3 Technical Manuals Part 3 – Preparation of Manuscript (Final, Typed) for Technical Manuals.

MIL-STD-12 Abbreviations for use on Drawings.

MIL-STD-15 Electrical and Electronic Symbols.

MIL-STD-16 Electrical and Electronic Reference Designations.

MIL-STD-17 Mechanical Symbols.

MIL-STD-103 Abbreviations (for Electrical and Electronic Use).

MIL-STD-129 Marking for Shipment and Storage.

DRAWINGS

BUREAU OF SHIPS

S0103-73729 – Standard Drawing Format for Production Drawings Prepared by Contractor or Manufacturer for approval by Government Agencies.

PUBLICATIONS

DEPARTMENT OF DEFENSE

DD441 (Attachment) – Industrial Security Manual for Safeguarding Classified Information.

(Copies of specifications, standards, drawings and publications required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

2.2 Other publications. – The following document forms a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

CONSOLIDATED CLASSIFICATION COMMITTEE

Consolidated Freight Classification Rules.

(Application for copies should be addressed to the Consolidated Classification Committee, 202 Chicago Union Station, Chicago 6, Ill.)

3. REQUIREMENTS.

3.1 General requirements.

3.1.1 Material. – The minimum material requirements shall be as specified hereinafter. A good grade of printing and materials shall be used when not definitely specified.

3.1.2 Identification. – Technical manuals shall be identified by a Navy identification number of the form "NAVSHIPS 300-0000" (see figures 1 and 2). Numbers will be assigned only by the Bureau of Ships upon receipt of a preliminary copy of the manual. In urgent cases, a letter request, containing complete descriptive data of the equipment, will be honored for the purpose of assigning a NAVSHIPS number (see 3.1.8.1). This number shall be imprinted on the upper left hand corner of the cover, and printed on the upper right hand corner of the title page of all final copies of the manuals prior to distribution (see figures 1 and 2).

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3.1.8.2.3 Figures. – Preliminary manuals shall contain a list of all figures (photographs, exploded views, and drawings) and shall include sample art work (all exploded views and sketches) which will appear in the final manual. If the final manual is to include test data, or a table of weights, for example, and if any of the items are not available when the preliminary manual is issued, then a foreword shall state which items have been omitted.

3.1.8.2.4 Manual identification. – In all instances where preliminary manuals are furnished in lieu of final manuals, the NAVSHIPS identification number preceded by the word "PRELIMINARY" shall be stamped or hand printed on the covers of all copies of the preliminary manuals prior to distribution (see 3.1.2). This number shall be imprinted on the upper left hand corner of the cover, and printed on the upper right hand corner of the title page.

3.1.8.2.5 Covers. – Covers for preliminary manuals shall be at least 20 by 26-65/500 - basis gray antique finish cover stock or similar material, bellows fold, with the title and other pertinent information on the cover. This information shall be identical with that which will appear on the final manual. (See figure 1).

3.1.8.2.6 Printing. – The text of preliminary manuals may be printed by any quick, economical method, such as multigraph, mimeograph or similar method.

3.2 Type I manuals. – The preparation and contents of the type I manuals shall be as specified in the individual contract or order.

3.3 Type II manuals. –

3.3.1 Contents. – Type II manuals shall contain the following information as applicable presented in the order listed (see figures 1 to 13 inclusive).

- Front matter.
- Section 1 - General information.
- Section 2 - Principles of operations.
- Section 3 - Operating instructions.
- Section 4 - Installation.
- Section 5 - Maintenance.
- Section 6 - Parts list.
- Section 7 - Drawings.
- Memorandum.

Note. – When a manual covers an equipment composed of several distinct units (for example, a generating set consisting of a diesel engine, a generator, a voltage regulator, and a controller), it may be necessary to arrange the manual in major divisions, each covering one unit. If so, the major divisions may be arranged by subdivisions, each corresponding to the requirements listed herein. The order listed herein may be altered with the approval of the Bureau or agency concerned.

3.3.1.1 Front matter. – The front matter for type II manuals shall consist of the following:

- (a) Cover.
- (b) Title page.
- (c) Approval and procurement record page.
- (d) List of effective pages.
- (e) Correction page.
- (f) Table of contents.
- (g) List of figures.
- (h) List of tables.

3.3.1.1.1 The list of effective pages shall be required in classified manuals only, and in multiple volume manuals shall be a separate page for the contents of each volume.

3.3.1.1.2 The title page, table of contents, list of figures and list of tables shall be a separate page for the contents of each volume.

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3.3.1.1.3 Approval and procurement record page. – In all final copies of the manual, the manufacturer shall include an approval and procurement record page inserted immediately following the title page. Figures 3a or 3b gives the format that shall be followed in its preparation.

3.3.1.1.4 List of effective pages. – A list of effective pages (see figure 4) shall be prepared for all final manuals classified for security purposes (see 3.1.4) and copies thereof. For multiple volume manuals there shall be prepared a separate list for the contents of each volume.

3.3.1.1.5 Correction page. – A correction page (see figure 5) shall be furnished for all final manuals and copies thereof for the purpose of making revisions in accordance with 3.1.6. For multiple volume manuals there shall be prepared a separate correction page for each volume.

3.3.1.1.6 Table of contents. – The table of contents (see figure 6) shall list all primary divisions and secondary subdivisions such as chapters, sections, and main paragraphs, with their corresponding paragraph numbers and page numbers. Where sub-manufacturers are furnishing associated equipment it shall be the responsibility of the prime contractor to integrate and reflect the information provided by the sub-manufacturers within the table of contents.

3.3.1.1.7 List of figures and drawings. – A list of figures (see figure 7) which have been assigned figure numbers shall be prepared. The list shall be arranged in numerical sequence by figure number and shall give the figure title (see 3.3.3.8) and page number.

3.3.1.1.8 List of tables. – The list of tables (see figure 8) shall follow the list of figures and drawings. It shall include all tables assigned numbers and shall be arranged in numerical sequence by table number.

3.3.1.2 Section 1 – General information. – This section shall include general data, an introduction, and a detailed description.

3.3.1.2.1 General data. – This portion of the manual shall contain the following data:

(a) Component list and performance design characteristics: The name of each component and the respective manufacturer's name with its complete rated performance characteristics for continuous or intermittent operation and, where applicable, maximum permissible overload characteristics and their duration. In addition, a description of the item shall be included to distinguish it from other items of the same general category. For instance, a motor shall be distinguished as to the specific type of motor for example, as a.c., synchronous, totally enclosed, etc.

- (b) Navy type designation.
- (c) Principal overall dimensions.
- (d) Weights (with or without packing).

(e) Allowable clearances, temperatures, pressures, pressure and blow range settings or tolerances shall be shown in tabular form.

3.3.1.2.2 Introduction. – This division shall include a general description of the equipment; explain briefly what it is, where it is used, what it will do, and the general overall and interrelated operation of the various units. All information of a general character applicable to the complete equipment shall also be given. Where the text contains technical terms, terms not commonly used, or symbols, definitions shall be included.

3.3.1.2.3 Detailed description. – This division shall contain a complete detailed description of units and assemblies which comprise the complete equipment; for example, ship service turbogenerator, the turbine, reduction gear, generator and exciter.

3.3.1.2.4 Section 2 – Principles of operation. – This division shall contain a brief resume of the principles of operation. Figures, sketches, performance curves, and schematic wiring diagrams shall be included to convey an understanding of the function and operation of the equipment (see 3.3.1.2.9).

3.3.1.2.5 Section 3 – Operating instructions. – Information shall include routine and emergency procedures, and safety precautions; maximum and minimum loads; normal temperature or pressure limits or both; trans-

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for from manual to automatic operation (or the reverse), to be observed in the starting, operating, stopping, and shutting down of the equipment. In addition, action(s) shall be described which should be taken in the event of power failure; control air failure; generating tube failure; lube-oil failure; steering gear failure; partial failure of equipment; and similar conditions. Action(s) described in the event of partial failure shall include, where practicable, those procedures necessary to provide continued service of the equipment until an opportune time is available to repair the equipment. Where operating procedures are to be performed in specific sequence, step-by-step procedures shall be given. Operations shall be numbered in the order in which they are performed. Operating data which is frequently referred to in operating the equipment shall be included. Tables and charts shall be used for the presentation of these instructions where varying operating conditions are encountered.

3.3.1.2.6 Section 4 – Installation. – This division shall contain methods of installation, including packing or unpacking, handling, preparation of foundation, alignment, precautions, mounting instructions, bolting diagrams, recommendations regarding shielding, safety guards, grounding or bonding.

3.3.1.2.7 Section 5 – Maintenance. –

3.3.1.2.7.1 Preventive maintenance. – This division shall cover all maintenance procedures, inspection, tests, test data, and adjustments which should be performed periodically and regularly for the purpose of preventing failure or impairment of the equipment. Routine maintenance check charts or instructions or both shall be provided. They shall include, but shall not necessarily be limited to the following:

- (a) A tabulation of periodic, routine, mechanical, and electrical tests and checks which should be accomplished regularly to insure continuity of service at optimum performance.
- (b) Tables or charts or both to indicate what is to be done, when it is to be done, and how to do it.
- (c) Utilization of the test facilities which may be incorporated in the various components.
- (d) Instructions for the care, inspection, and cleaning of all pertinent parts.
- (e) Instructions stressing the importance of properly maintaining any safety devices or interlocks provided to prevent damage to equipment or injury to personnel.
- (f) Instructions on lubrication shall be provided as applicable, preferably in chart form. They shall include information regarding lubrication recommended by the manufacturer, the type of lubricant to be used, together with specific time periods. Lubricants shall be described by Military specification numbers where applicable and by commercial designations.

3.3.1.2.7.2 Corrective maintenance. – This division shall cover all information necessary to permit a technician to locate trouble, and to make repairs, adjustments and conduct tests of each component, assembly or sub-assembly of the equipment upon initial installation or under other conditions such as after major overhaul where complete readjustment may be required. Included in this division shall be the following:

- (a) Trouble shooting guides for the localization of faults giving possible sources of trouble, the symptoms, probable cause, and instructions for remedying the faults.
- (b) Complete instructions on signal tracing for electric circuits, use of test instruments and other common servicing techniques.
- (c) Ample figures, photographs, exploded views giving details of mechanical assemblies, and simplified schematic diagrams of electrical, mechanical, hydraulic and pneumatic circuits. Figures contained in other divisions may be used and referred to under this division without duplicating them.

3.3.1.2.8 Section 6 – Parts list. – This section shall contain identification data covering all repair parts to facilitate ready identification of parts for replacement and ordering purposes. Do not list standard hardware, structural parts, indicating instrument parts or other parts which have no maintenance significance.

3.3.1.2.8.1 Contents. – The parts list shall contain the following subdivisions:

- (a) Introduction.
- (b) Parts tabulation.
- (c) Special tools.

3.3.1.2.8.1.1 Introduction. – This division shall contain sufficient instructions to explain the following:

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3.3.2.5.1 Fold over pages shall be right hand pages printed on one side only and when they are used they shall be assigned two page numbers. The page numbers shall appear on the face of the sheet at the lower righthand corner (see figure 13). Fold over pages shall be arranged so that page numbers and figure numbers are visible without unfolding. Fold over arrangements shall be as shown on figure 13.

3.3.2.6 Layout treatment. – The layout of the manuals shall be such as to conserve space without detracting from the utility or clarity of the material presented. Blank pages and spaces shall be avoided wherever possible with the exception specified in 3.3.1.2.10 and in 3.3.2.6.1. Normally, textual material shall be printed on both sides of the sheet. Figures serving no instructional function or to which no reference is made in the text shall not be used. Partial page figures within the text are highly desirable although several small figures may be grouped to form a single page layout. Whenever possible, figures within the text shall be located so that reference can be made from applicable text without turning a page. Whenever it is necessary to include fold over pages they shall be inserted at the end of the applicable division, chapter or section.

3.3.2.6.1 All drawings which are inserted as fold over pages shall be provided with a blank apron page at the left hand edge of the fold over page (see figure 13). This will permit the printed portion in its entirety to be visible while the text is being studied.

3.3.3 Text. –

3.3.3.1 Wording. – The text shall be factual, specific, concise, and clearly worded so as to be readily understandable to relatively inexperienced personnel involved in the operation and maintenance of the equipment, yet provide technicians with sufficient information to install, operate, service, and maintain the equipment at peak performance. Technical phraseology requiring a specialized knowledge shall be avoided except where no other wording will convey the intended meaning, in which case the technical term shall be defined.

3.3.3.2 Emphasis. – When necessary, emphatics such as "NOTE", "CAUTION", and "WARNING" shall be used as adjuncts to the text. These, however, shall be used as sparingly as is consistent with the real need. The appropriate adjunct to the text shall be selected in accordance with the following definition:

- (a) "NOTE" – An operating procedure, condition, etc., which it is essential to highlight.
- (b) "CAUTION" - Operating procedures, practices, etc., when if not strictly observed, will result in damage or destruction of equipment.
- (c) "WARNING" – Operating procedures, practices, etc., which will result in personal injury or loss of life if not correctly followed.

3.3.3.3 Grammatical person and mode. – The second person imperative shall be used for operational procedures; for example: "Disengage jacking gear from main engine reduction gears". The third person indicative shall be used for description and discussion; for example: "The jacking gear rotates the main shaft and main engine by engagement of the main reduction gears".

3.3.3.4 Nomenclature consistency. – Nomenclature used shall be consistent throughout the manual. For example, a part once identified as a "cover" shall not be referred to elsewhere as a "plate". That portion of the nomenclature that is used shall agree with the parts list nomenclature.

3.3.3.5 Tables and charts. – The use of tables and charts is desirable. Tables and charts shall be as simple as possible with sufficient explanation to make them easily used and understood. When material is presented in tabular form for ready reference purposes, as when listing weights, measures, condensed trouble shooting information, etc., the tabulation shall be numbered by table (or chart) number and chapter (or section) number. Thus, table 3 in chapter 4 shall be numbered table 4-3.

3.3.3.6 Measures. – The system of standard U. S. customary units of weights and measures shall be used. As a general rule all references to liquid capacities shall be given in U. S. standard units of liquid measure. When scientific or medical equipment is of a type which makes references to metric weights and measures customary, such references may be used.

3.3.3.6.1 Temperature references. – Temperature readings shall be given in degrees Fahrenheit or degrees Centigrade (Celsius), whichever is standard in U. S. industry. (In general, Fahrenheit is used with mechani-

containing less than 50 pages (25 sheets), split type metallic fasteners with metallic washers may be used. All metal parts shall be of corrosion-resisting material, or shall be treated to resist corrosion.

3.3.4.6.1 Fillers. — Fillers made of newsboard or similar material shall be inserted where needed to build up the binding edge to the same thickness as the outside edge. Fillers shall be spaced throughout the binding edge of the manual such that the pages of the manual shall not be bent.

3.3.4.7 Drawings. — When drawings are necessary to illustrate the description, operation and maintenance of the equipment or system, they shall be reduced in size as necessary (see figure 13) and reproduced in black and white. Each drawing shall be identified with the drawing number of the manufacturer and the bureau or agency concerned. See 3.3.2.6 regarding partial page figures and fold-over pages. Care shall be taken in the preparation of drawings for reproduction to insure that when the drawings are reduced in size they shall be clear and legible.

3.3.4.8 Figures. — (NOTE: This paragraph does not pertain to reduced size reproduction of approved drawings which may be extracted and used as figures in a manual.) The rendering of sketches (airbrushing or line rendering) shall be done with the highest possible contrast. Adjoining area of a figure having similar values shall be avoided. Edges of all silhouette half-tone figures shall be sharply defined by retouching. Exploded views and cutaways shall be drawn in perspective to appear as realistic as possible without distortion. Isometric views may be used for small parts or units which lend themselves to this method without showing noticeable distortion. Except for diagrams, schematic, orthographic projections, reproduction of approved drawings, all line sketches shall be prepared with the use of shading medium to clarify and model the form of the sketch. This rendering shall be kept as simple as possible. Fuzzy freehand lines, rendering with fine lines, and cross hatching shall be avoided. Solid black shall be used in dark areas to increase contrast and simplify the sketch. This applies to cutaway views, exploded views and cross section views.

3.3.4.9 Reproduction copy. — Reproduction copy shall be prepared in accordance with 3.3.4.3. If offset negatives are used in the publication of the manuals, a complete set of such negatives shall, after completion of the manuals, be delivered to the Naval Supply Depot, Mechanicsburg, Pennsylvania and shall remain the property of the Government for use in subsequent reproduction of the manuals. Regardless of the method of printing used, one glossy print or negative of each halftone figure included in the manuals, shall be delivered to the Naval Supply Depot, Mechanicsburg, Pennsylvania and shall remain the property of the Government for use in subsequent reproduction of the manuals. This requirement does not apply to manuals for which reproduction copy has been previously furnished. Where color is used (see 3.3.4.2) suitable copy for each separate color plate will be rendered properly identified showing register marks. Color plates shall also be forwarded to Naval Supply Depot, Mechanicsburg, Pennsylvania.

3.3.4.10 Security requirements. — The security requirements prescribed in Section IX — Graphic Arts of the Industrial Security Manual (DD Form 441-Attachment) shall be observed during the production, reproduction, and distribution of graphic arts involving classified information.

3.4 Type III manuals. —

3.4.1 Contents. — Type III manuals shall contain the following information as applicable presented in the order specified as follows (see figures 1 to 13 inclusive):

- Front matter
- Section 1 — General information
- Section 2 — Operating instructions.
- Section 3 — Installation.
- Section 4 — Maintenance.
- Section 5 — Parts list.
- Section 6 — Drawings.
- Memorandum.

Note. — When a manual covers an equipment composed of several distinct units (for example, a pump unit consisting of a pump and motor), it may be necessary to arrange the manual in major divisions, each covering one unit. If so,

3.4.3.1 Wording. – The text shall be factual, specific, concise, and clearly worded so as to be readily understandable to relatively inexperienced personnel involved in the operation and maintenance of the equipment, yet provide technicians with sufficient information to install, operate, service, and maintain the equipment at peak performance. Technical phraseology requiring a specialized knowledge shall be avoided except where no other wording will convey the intended meaning, in which case the technical term shall be defined.

3.4.3.2 Emphasis. – When necessary, emphatics such as “NOTE”, “CAUTION”, and “WARNING” shall be used as adjuncts to the text. These, however, shall be used as sparingly as is consistent with the real need. The appropriate adjunct to the text shall be selected in accordance with the following definitions:

- (a) “NOTE” – An operating procedure, condition, etc., which it is essential to highlight.
- (b) “CAUTION” – Operating procedures, practices, etc., when if not strictly observed, will result in damage or destruction of equipment.
- (c) – “WARNING” – Operating procedures, practices, etc., which will result in personal injury or loss of life if not correctly followed.

3.4.3.3 Grammatical person and mode. – The second person imperative shall be used for operational procedures; for example: “Disengage jacking gear from main engine reduction gears.” The third person indicative shall be used for description and discussion; for example: “The jacking gear rotates the main shaft and main engine by engagement of the main reduction gears.”

3.4.3.4 Nomenclature consistency. – Nomenclature used shall be consistent throughout the manual. For example, a part once identified as a “cover” shall not be referred to elsewhere as a “plate”. That portion of the nomenclature that is used shall agree with the parts list nomenclature.

3.4.3.5 Tables and charts. – The use of tables and charts is desirable. Tables and charts shall be as simple as possible with sufficient explanation to make them easily used and understood. When material is presented in tabular form for ready reference purposes, as when listing weights, measures, condensed trouble shooting information, etc., the tabulation shall be numbered by table (or chart) number and chapter (or section) number. Thus table 3 in chapter 4 shall be numbered table 4-3.

3.4.3.6 Measures. – The system of standard U. S. customary units of weights and measures shall be used. As a general rule all references to liquid capacities shall be given in U. S. standard units of liquid measure. When scientific or medical equipment is of a type which makes reference to metric weights and measures customary, such reference may be used.

3.4.3.6.1 Temperature reference. – Temperature readings shall be given in degrees Fahrenheit or degrees Centigrade (Celsius), whichever is standard in U. S. industry. (In general, Fahrenheit is used with mechanical equipment and Centigrade (Celsius) is used with electric equipment.) One may follow the other in parentheses, for example: 194°F. (90°C) or 90°C. (194°F.).

3.4.3.7 Figures. – A view of each assembly, sub-assembly and the component parts thereof shall be shown as necessary to supplement the text and aid in the identification of parts. Identification of illustrated parts with the listed parts shall be facilitated by the use of key numbers (or more commonly known as piece numbers or index numbers) and arrows which will identify assemblies, sub-assemblies, and component parts. Figures of the exploded type may be used. When the use of exploded views is not practical, simple cross sectional views may be used. It is preferable when cross sectional views are used that they be approved drawings or excerpts from approved drawings. In the event no applicable drawing is available, cross sectional views from manufacturer's drawings may be used. Reduced figures for reproductions from validated master figures do not require revalidation.

3.4.3.8 Figure titles. – Figure titles shall indicate clearly in a brief descriptive phrase what is portrayed, by giving the function or process illustrated, the nomenclature of the equipment shown, or other pertinent and quickly understood identification.

Examples:

- (a) Wing hydraulic system.